ORGANIC ELECTRONIC DEVICES HAVING EXTERNAL BARRIER LAYER

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BACKGROUND

The invention relates generally to organic electronic devices, and more particularly to organic lighting devices.

In recent years, organic electronic devices, such as, but not limited to, organic light emitting devices, organic photovoltaic cells, organic electrochromic devices, organic transistors, organic integrated circuits, and organic sensors, have attracted much attention as high performance alternatives to silicon electronic devices due to low cost and compatibility with flexible substrates.

In the last decade, tremendous progress has been made in the area of organic electronic devices. Previously, liquid crystal displays (LCDs) were employed for most display applications. However, the LCD displays involve high production and commercial expenses. Currently, organic electronic devices, such as, but not limited to, organic light emitting devices, are being increasingly employed for applications, such as display applications and area lighting applications.

As will be appreciated by one skilled in the art, an organic light emitting device, such as an organic light emitting diode (OLED), includes a stack of thin organic layers sandwiched between two electrodes. The organic layers comprise at least one emissive layer. Other layers may include a hole injection layer, a hole transport layer, and an electron transport layer. Upon application of an appropriate voltage to the OLED lighting device, where the voltage is typically between 2 and 10 volts, the injected positive and negative charges recombine in the emissive layer to produce light. Further, the structure of the organic layers and the choice of anode and cathode are designed to maximize the recombination process in the emissive layer, thus maximizing the light output from the OLED device. This structure eliminates the need for bulky and environmentally undesirable mercury lamps and yields a thinner, more versatile and more compact display or area lighting device. In addition, the OLEDs advantageously consume little power. This combination of features enables OLED displays to advantageously communicate more information in a more engaging way while adding less weight and taking up less space.

Currently, organic electronic devices, such as OLEDs, typically include a glass substrate. The glass substrate permits light to escape from the OLEDs, while preventing exposure of the OLED to moisture and oxygen. As will be appreciated, moisture and oxygen present in the atmosphere are known in the art to produce deleterious effects such as degradation of optical and/or electrical properties of the OLEDs. For example, exposing organic materials in the OLEDs to oxygen and moisture may severely limit the lifetime of the OLEDs. Further, moisture and oxygen are known in the art to increase "dark spots" and pixel shrinkage in connection with OLEDs.

Generally, the OLEDs are manufactured employing a batch process. However, in order to reduce the cost of manufacture, it may be desirable to process the devices in a continuous fashion. One mechanism for facilitating continuous processing is to implement a roll-to-roll flexible substrate onto which the OLEDs are fabricated. Consequently, substrates have migrated from rigid glass to flexible glass or plastic. Employing plastic substrates in the fabrication of OLEDs generally leads to the use of plastic substrates having internal barrier layers or the use of a plastic substrates having barrier properties to prevent moisture and oxygen from penetrating through the plastic substrates. Both flexible glass and barrier-coated plastic substrates tend to be fragile entailing considerable attention to prevent loss of hermetic properties during processing. Furthermore, processing steps such as scribing or embossing that are typically employed to generate fine features in the electrodes may result in physical damage to the fragile substrates.

It may therefore be desirable to develop a technique to facilitate cost-effective, continuous processing of OLEDs on a flexible, robust plastic substrate without the barrier layer, while ensuring that the OLEDs do not suffer from permeating of environmental elements once they are ready for implementation, thereby circumventing the limitations of current techniques.

BRIEF DESCRIPTION

Briefly, in accordance with aspects of the present technique an organic device package is presented. The organic device package includes a flexible substrate having a topside and a bottom side. Further, the organic device package includes an organic electronic device having a first side and a second side disposed on the topside of the flexible substrate. In addition, the organic device package includes a first barrier layer disposed on the bottom side of the flexible substrate.

In accordance with another aspect of the present technique, a method of fabricating an organic device package is presented. The method includes providing a flexible substrate having a topside and a bottom side. Additionally, the method includes disposing an organic electronic device having a first side and second side on the topside of the flexible substrate. The method also includes disposing a first barrier layer on the bottom side of the flexible substrate. Furthermore, the method includes disposing a second barrier layer proximate to the first side of the organic electronic device such that a periphery of the second barrier layer is adapted to wrap around edges of the organic device package. Also, the method includes coupling the second barrier layer to a side of the first barrier layer opposite the flexible substrate.

In accordance with yet another aspect of the present technique, an organic device package is presented. The organic device package includes a flexible substrate having a topside and a bottom side. In addition, the organic device package includes an organic electronic device having a first side and second side disposed on the topside of the flexible substrate. Further, the organic device package also includes a first barrier layer having an inner surface and an outer surface disposed on the bottom side of the flexible substrate. Additionally, the organic device package includes a second barrier layer having an inner surface and an outer surface disposed proximate to the first side of the organic electronic device. The organic device package also includes an edge encapsulating material disposed about the perimeter of the organic electronic device between the first and second barrier layers, where the edge encapsulating material is configured to hermetically seal peripheral edges of the organic device package.

In accordance with yet another aspect of the present technique, a method of fabricating an organic device package is presented. The method includes providing a flexible substrate having a topside and a bottom side. The method also includes disposing an organic electronic device having a first side and a second side on the topside of the flexible substrate. Further,